IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Harilaos Kavvadias and Damianos Markakis	
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Filed	:	07/16/2004	
Title	:	STRETCH FILM	
Group Art Unit.	:	1772	Examiner: William P. Watkins, III
Attorney Docket	:	MH0857US.RCE (#90556)	

DECLARATION

I, Damianos Markakis, declare and say as follows:

1. I am one of the inventors of the above-identified patent application.

2. My background includes the following schools I have attended:

Technical School for Electricians

3. I belong to the following professional organizations:

4. I have been actively involved in the development of plastic films since 1985.

5. Claim 1 of the present invention defines "at least one layer of strips consisting of a film material and extending in the main direction wherein at least one layer of strips is attached to the base between the rows of holes, said at least one layer of strips being devoid of said holes" and "wherein the strips are generally even, but at least without wrinkles." The limitation of the strips being generally even, but at least without wrinkles is an important

aspect of the present invention, and is not disclosed by the prior art documents cited in the present Office action, namely, Paulett (US 5,935,681), Tiozzo (EP 0909721 A1) and Heikaus et al. (WO 01/60709 A1).

6. A reinforcement strip which is folded, as defined by the present invention, cannot be "generally even" or "without wrinkles." Rather, the folding itself is a big wrinkle. The reinforcement strip of the present invention has no wrinkles and no foldings, and thus is generally even. Folding of the reinforcement strip leads to rounded edges which could weaken the whole stretch film. There is a potential risk that the folded reinforcement strip could loosen from the basic stretch film. U.S. Publication No. 2005/0123721 to Heikaus et al. discloses folded sheets, and this point is conceded by the Examiner on page 5 of the present Office action dated March 18, 2008. Additionally, European Patent EP 0 909 721 to Tiozzo and U.S. Patent No. 5,935,681 to Paulett do not disclose the limitation that the "strips should be generally even, but at least without wrinkles."

7. Furthermore and regarding the Paulett reference, there is no explicit or inherent disclosure of the limitation in claim 1 that the weld/rim must have a thickness thicker than the thickness of the sheet. The specification of the Paulett does not discuss the thickness of the weld/rim at all. Further, it is not clear from Figs. 2 and 3 of Paulett if the weld/rim is indeed thicker than the thickness of the sheet. It appears that the weld/rim of Paulett can be either the same or a lower thickness than the thickness of the sheet. Therefore, Paulett does not disclose the limitation in claim 1 that the weld/rim must have a thickness thicker than the thickness of the sheet.

8. To the best of my knowledge, it has heretofore been unknown to avoid folding, to avoid the presence of wrinkles, or to surround each hole in the stretch film with a

bead having a thickness exceeding the thickness of the base of the film, to increase the strength of the film or for any other reason.

9. Attached herewith is a sample of the stretch film according to the present invention, showing no folds or wrinkles and having a rim with a thickness greater than the thickness of the sheet.

10. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

18 - 6 - 2008

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Title: SENIOR TECHNICAL ADVISOR
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Date

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(21) Application number: **94400696.4**

(22) Date of filing: **30.03.1994**

(54) **Method to improve welding of profiled plastic film or tape**

Verfahren zum Verschweissen von mit einem Profil versehene Folien oder Bändern aus Kunststoff

Procédé pour le soudage de films ou de bandes pourvus d'un profil

(84) Designated Contracting States:
BE FR

(30) Priority: **30.03.1993 US 39919**

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(56) References cited:
EP-A- 0 005 776
US-A- 5 063 639
US-A- 5 046 300

EP 0 620 105 B1

Description

Background of the Invention

1. Field of the Invention

[0001] The present invention relates to the manufacture of plastic bags or packages having at least two plies of thermoplastic sheeting, both plies having closure stripe formed or included on their facing inner edges so as to form a snap fastener-like closure for the openings of the bags or packages made therefrom.

2. Description of the Prior Art

[0002] The present invention relates to improvements in the package-making art and may be practiced, without limitation, in the manufacture of thermoformed bags and thermoformed trays of the kind that may be used for various consumer products, but which are particularly useful for food products which should be kept in substantially air-tight packages, free from leakage until opened for access to the product contents, which packages are desirably reclosable by zipper means to protect any remainder of the product therein.

[0003] The indicated art is fairly well developed, but nevertheless is still susceptible of improvements contributing to increased efficiency and cost effectiveness.

[0004] One problem that still exists in the production of packages from continuous zipper-equipped sheet material, such as film, especially where the film and zipper are separately formed and then joined, resides in the difficulty in dividing the zippered film into package-oriented sections, because the zipper is of greater mass than the film.

[0005] Another problem is represented by the difficulty in attaining a satisfactory sealing of the zipper against leakage, where the zipper and the area of film engaged by the zipper extends through the side seal areas separating one bag or package from the next.

Summary of the Invention

[0006] The present invention provides a solution to the foregoing problems by requiring a cut-out to be made through the female profile section of the plastic zipper before a weld is applied for a permanent joint, the weld being the means by which a side seal is provided, which side seal also separates the zippered film into package-oriented sections. It should be understood that the cut-out is to be made at the point where the weld is subsequently to be made. The weld may be provided by a seal bar or seal jaws.

[0007] While the cut-out is preferably made through the female profile section, it may be provided in the male profile section as an alternative. In any event, the cut-out is to be provided through only one of the two (male or female) sections.

[0008] Since the cut-out is made through only one of the two profile sections, one need not be concerned about maintaining the coincidence of cut-outs made in both the male and female profile sections, as is required by currently used methods. As a consequence, sealing will not be required to prevent shifting of the profiles relative to one another.

[0009] The present invention may be utilized in the manufacture of plastic bags, as well as on plastic zippered containers, tape or film, and will be described in more complete detail below with reference being made to the following figures.

Brief Description of the Drawings

[0010]

Figure 1 is a perspective view of two plastic sheets, one of which has a male profile section and the other of which has a female profile section, the latter having a cut-out in accordance with the present invention.

Figure 2 is a schematic cross-sectional view taken as indicated by line 2-2 in Figure 1.

Figure 3 is the view shown in Figure 2 after the male profile section has been inserted into the female profile section.

Figure 4 is the view shown in Figure 3 after the male profile section has been welded to the female profile section to form a side seal area.

Detailed Description of the Preferred Embodiment

[0011] Figure 1 is a perspective view of two plastic sheets 10,12, which may be two side panels of a plastic bag, two sheet-like parts of a plastic container, or the like. A male profile section 14 is attached to the upper plastic sheet 10 either as a result of having been coextruded therewith or having been extruded and thereafter affixed to the upper plastic sheet 10.

[0012] In a similar fashion, a female profile section 16 is attached to the lower plastic sheet 12 either as a result of having been coextruded therewith or having been extruded and thereafter affixed to the lower plastic sheet 12.

[0013] A portion of the female profile section 16 has been cut out and a hole 18 provided through the underlying lower plastic sheet 12 in the same operation. Alternatively, a portion of the male profile section 14 may be cut out and a hole 18 provided through the upper plastic sheet 10.

[0014] Figure 2 is a cross-sectional view taken as indicated by line 2-2 in Figure 1, showing clearly that hole 18 passes through lower plastic sheet 12 beneath the cut-out portion of the female profile section 16. Figure 3 presente a view of the profiles shown in Figure 2 after the male profile section 14 has been inserted, or zipped, into the female profile section 16.

[0015] Figure 4 is the view shown in Figure 3 after the male profile section 14 has been welded to the female profile section 16 to form a side seal area 20. As may be observed, the welded side seam area 20 is thinner than the unwelded areas on either side. This is the result of material having been removed by cutting out part of the female profile section 16 and providing the hole 18.

[0016] The punch unit, which provides the cut-out and hole, may be located in bag making equipment, an extrusion line, a VFFS machine or a HFFS machine.

[0017] The present invention offers the manufacturers of plastic bags and other packaging several distinct advantages. For one, it reduces the stomping time required by an ultrasonic welder to flatten the profiled section. This, in turn, leads to the possibility of increased production. Secondly, it decreases the leakage rate in the plastic bags and packages incorporating the invention by closing the profile channels through molten plastic flow. Thirdly, stomping reduces the profile area thickness by 90% compared to the presently realized reduction of 70%. Finally, VFFS and HFFS machines do not require zippered film to be prestamped.

[0018] It should be readily understood that modifications to the above would be obvious to anyone skilled in the art without departing from the scope of the appended claims.

Claims

1. A method for providing a welded seam (20) in a plastic package having a zipper comprising:

   providing a sheet (12) of plastic material having a continuous female profile section (16);
   providing a sheet of plastic material (10) having a continuous male profile section (14);
   characterized in that said method further comprises the steps of:
   punching a plurality of cut-outs (18) at preselected intervals along one of said continuous female profile section or continuous male profile section (16, 14), said cut-outs (18) removing sections of one of said profile sections and forming holes through the sheet of plastic material contiguous therewith;
   inserting said continuous male profile section (14) into said continuous female profile section (16) to join said sheets of plastic material (10, 12) together; and
   welding said sheets of plastic material together along lines including said cut-outs.

2. A method as claimed in claim 1 wherein said cutouts (18) are punched through said continuous female profile section (16).

3. A method as claimed in claim 1 wherein said cutouts are punched through said continuous male profile section (14).

Patentansprüche

1. Verfahren zur Herstellung einer Schweißnaht (20) in einer Kunststoffverpackung mit einem Reißverschluß, welches umfaßt:

   Bereitstellung eines Bogens (12) aus Kunststoffmaterial, welcher einen durchgehenden aufnehmenden Profilabschnitt (16) aufweist;
   Bereitstellung eines Bogens aus Kunststoffmaterial (10), welcher einen durchgehenden eingreifenden Profilabschnitt (14) aufweist;
   dadurch gekennzeichnet, daß das Verfahren außerdem die Schritte aufweist:
   Ausstanzen einer Vielzahl von Ausschnitten (18) in vorab gewählten Abständen entlang des durchgehenden aufnehmenden Profilabschnitts oder des durchgehenden eingreifenden Profilabschnitts (16, 14), wobei die Ausschnitte (18) Abschnitte eines der Profilabschnitte entfernen und Löcher durch den daran angrenzenden Bogen aus Kunststoffmaterial bilden;
   Einlegen des durchgehenden eingreifenden Profilabschnitts (14) in den durchgehenden aufnehmenden Profilabschnitt (16), um die Bögen aus Kunststoffmaterial (10, 12) aneinander zu befestigen; und
   Verschweißen der Bögen aus Kunststoffmaterial aneinander entlang der die Ausschnitte beinhaltenden Linien.

2. Verfahren gemäß Anspruch 1, bei welchem die Ausschnitte (18) durch den durchgehenden aufnehmenden Profilabschnitt (16) gestanzt werden.

3. Verfahren gemäß Anspruch 1, bei welchem die Ausschnitte durch den durchgehenden eingreifenden Profilabschnitt (14) gestanzt werden.

Revendications

1. Procédé de réalisation d'une couture soudée (20) dans un emballage plastique équipé d'une fermeture à glissière, comprenant les étapes consistant à :

   prévoir une feuille (12) de matière plastique ayant une section profilée femelle continue (16);
   prévoir une feuille de matière plastique (10) ayant une section profilée mâle continue (14);
   caractérisé en ce que ledit procédé comprend en outre les étapes consistant à :
   réaliser par perforation une pluralité de décou-

pes (18) à intervalles présélectionnés le long d'une desdites sections profilées femelle ou mâle continues (16 ; 14), lesdites découpes (18) supprimant des sections de l'une desdites sections profilées et formant des trous à travers la feuille de matière plastique contiguë à celles-ci ;

insérer ladite section profilée mâle continue (14) dans ladite section profilée femelle continue (16) pour joindre lesdites feuilles de matière plastique (10, 12) l'une à l'autre ; et

souder lesdites feuilles de matière plastique l'une à l'autre le long de lignes incluant lesdites découpes.

2. Procédé selon la revendication 1, dans lequel lesdites découpes (18) sont réalisées par perforation à travers ladite section profilée femelle continue (16).

3. Procédé selon la revendication 1, dans lequel lesdites découpes sont réalisées par perforation à travers ladite section profilée mâle continue (14).

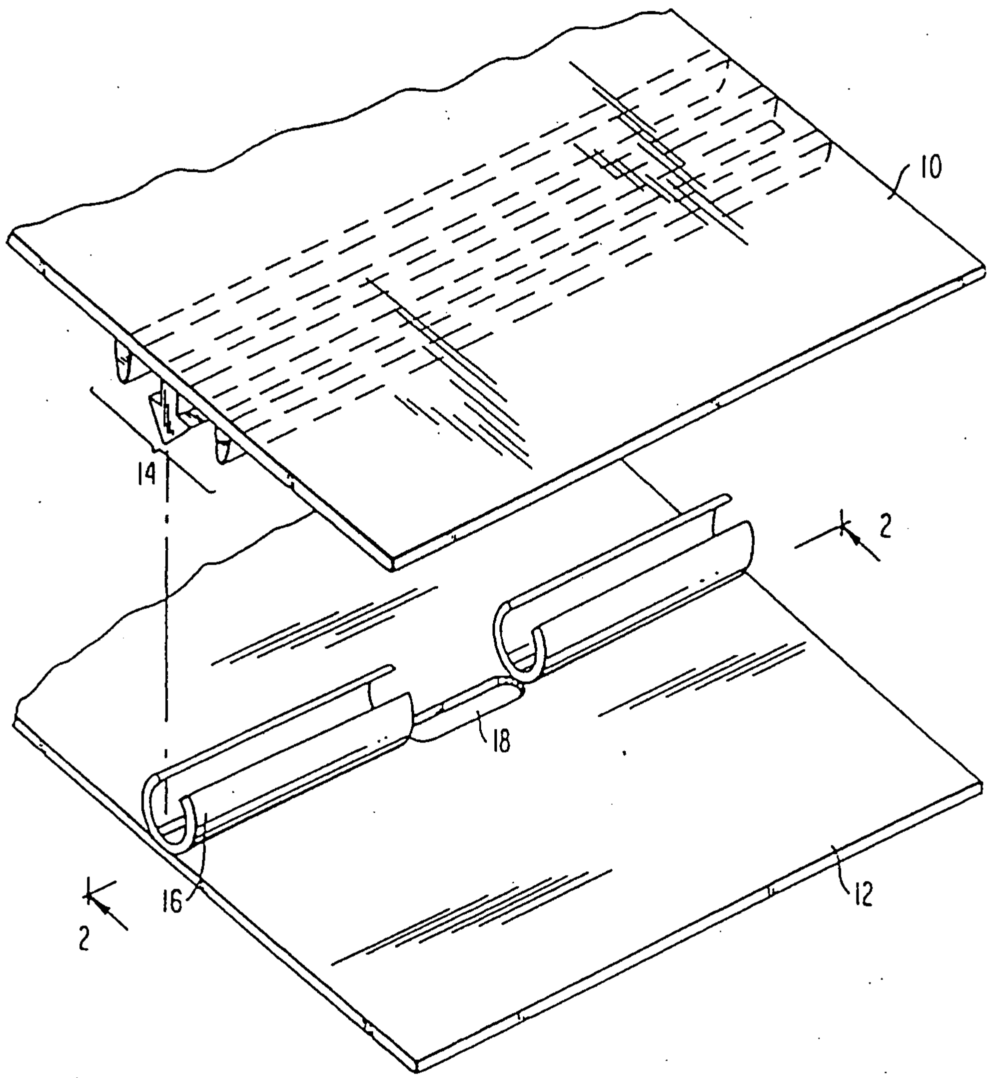

FIG. 1

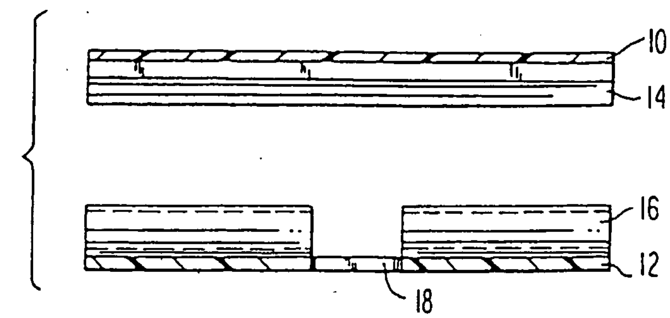

FIG. 2

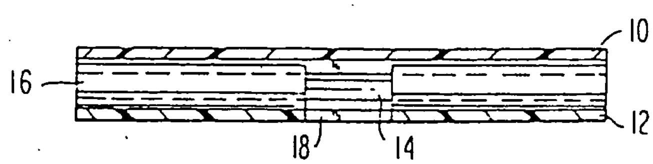

FIG. 3

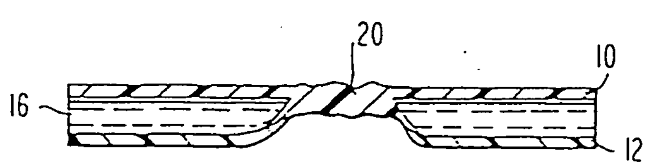

FIG. 4

PolyFab

Plastic Welding

The fundamental requirement for plastic welding is that the filler material has properties very close to those of the base material. The plastics we normally weld are polypropylene, polyethylene, PVC, CPVC, ABS, polycarbonate, and acrylic. This is just the list of our most common work; many other plastics can be welded.

Welds in material thinner than 3/8" are normally done with a hand torch which passes electrically heated air over the rod and also over the surfaces of the pieces to be joined. All of the weld types used in metal welding can be used in plastics, ie butt welds, lap welds, corner welds, etc. Proper beveling of the surfaces is critical because much less of the base material is melted in plastic welding than is metal welding.

For materials 3/8" and thicker, the strongest welds are done with an extruder. This machine melts the welding rod in an electrically heated chamber and forces the soft material onto the workpieces in a thick line typically of about the same diameter as the thickness of the pieces being welded.

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Introduction to Elasticity/Plate with hole in tension

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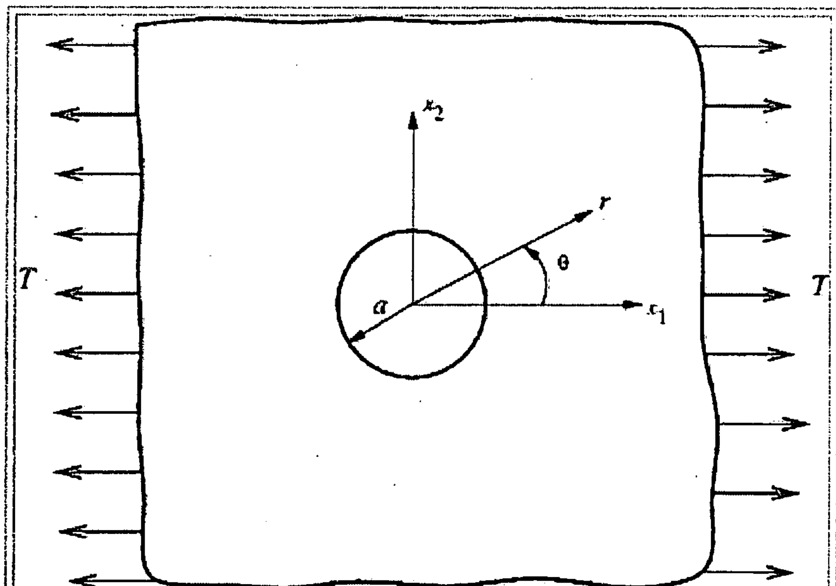
Contents

Plate with hole in a tensile field



An elastic plate with a circular hole under tension

The BCs are

$$\text{(124)} \qquad \text{at } r = a \quad t_r = t_\theta = 0 \; ; \quad \widehat{\mathbf{n}} = -\widehat{\mathbf{e}}\, r \Rightarrow \sigma_{rr} = \sigma_{r\theta} = 0$$

$$\text{(125)} \qquad \text{at } r \rightarrow \infty \qquad \sigma_{11} \rightarrow T \; ; \quad \sigma_{12} \rightarrow 0 \; ; \quad \sigma_{22} \rightarrow 0$$

Unperturbed Solution

The unperturbed part of the Michell solution gives us

$$\varphi = \frac{Tx_2^2}{2} = -\frac{T(r\sin\theta)^2}{2} = \frac{Tr^2}{4} - \frac{Tr^2\cos(2\theta)}{4}$$

or,

$$\varphi = \frac{Tr^2}{4} - \frac{Tr^2\cos(2\theta)}{4} \qquad (126)$$

The first term is the *axisymmetric* term while the second term is the *periodic* term.

Perturbation

Similar to previous problem, but we simply choose terms from the Michell solution of the same form (i.e. containing cos(2θ)) and such that the stresses decay with increasing radius. The relevant terms from the table are:

$$\ln(r)~,~~\theta~,~~r^{-2+2}\cos(2\theta)~,~~r^{-2}\cos(2\theta) \qquad (127)$$

Perturbed Solution

The perturbed solution is

$$\varphi = \frac{Tr^2}{4} - \frac{Tr^2\cos(2\theta)}{4} + A\ln(r) + B\theta + C\cos(2\theta) + Dr^{-2}\cos(2 \qquad (128)$$

After applying the BCS, we get

$$\sigma_{rr} = \frac{S}{2}\left(1 - \frac{a^2}{r^2}\right) + \frac{T\cos(2\theta)}{2}\left(\frac{3a^4}{r^4} - \frac{4a^2}{r^2} + 1\right) \qquad (129)$$

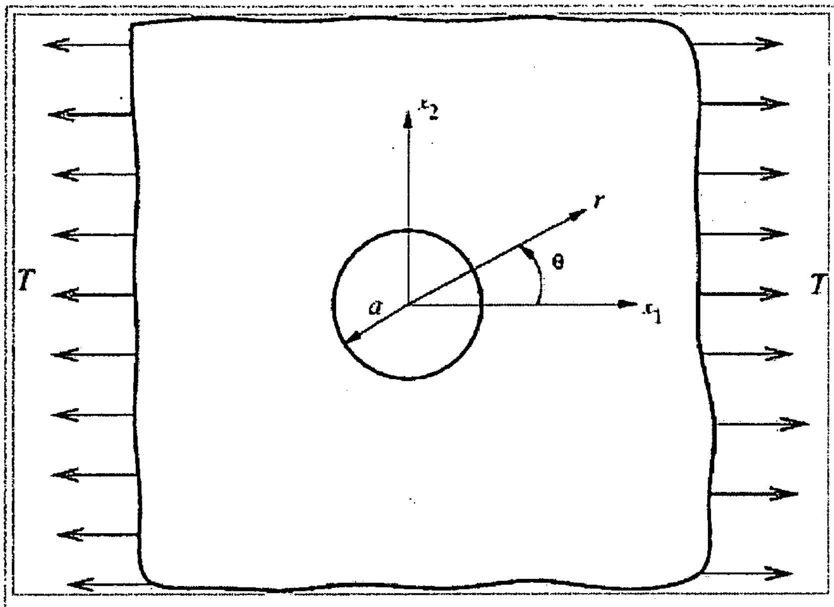
$$\sigma_{\theta\theta} = \frac{T}{2}\left(1 + \frac{a^2}{r^2}\right) - \frac{T\cos(2\theta)}{2}\left(\frac{3a^4}{r^4} + 1\right) \qquad (130)$$

$$\sigma_{r\theta} = \frac{T\sin(2\theta)}{2}\left(\frac{3a^4}{r^4} - \frac{2a^2}{r^2} - 1\right) \qquad (131)$$

The stress concentration factor in this case is 3 and is the same in both tension and shear.

Example homework problem

Consider the elastic plate with a hole subject to uniaxial tension.



Elastic plate with small circular hole under uniaxial tension

- Show that the stress function

$$\varphi = \frac{Tr^2}{4} - \frac{Tr^2\cos(2\theta)}{4} + A\ln(r) + B\theta + C\cos(2\theta) + Dr^{-2}\cos(2\theta)$$

leads to the stresses

$$\sigma_{rr} = \frac{T}{2}\left(1 - \frac{a^2}{r^2}\right) + \frac{T\cos(2\theta)}{2}\left(\frac{3a^4}{r^4} - \frac{4a^2}{r^2} + 1\right)$$
$$\sigma_{\theta\theta} = \frac{T}{2}\left(1 + \frac{a^2}{r^2}\right) - \frac{T\cos(2\theta)}{2}\left(\frac{3a^4}{r^4} + 1\right)$$
$$\sigma_{r\theta} = \frac{T\sin(2\theta)}{2}\left(\frac{3a^4}{r^4} - \frac{2a^2}{r^2} - 1\right)$$

- Calculate the stress concentration factors at the hole, both in shear and in tension and show that they are the same. How far from the hole (in units of hole diameters) does the stress reach 95% of the far field (unperturbed) value ?
- Calculate the displacement field corresponding to this stress field (for plane stress). Plot the deformed shape of the hole.

Solution

We can use the following Maple code to show the above results

```
phi := T*r^2/4*(1 - cos(2*theta)) + A*ln(r) + B*theta + C*cos(2*theta) +
       D/r^2*cos(2*theta);

srr := 1/r*diff(phi,r) + 1/r^2*diff(phi,theta,theta);
stt := diff(phi,r,r);
srt := -diff((1/r*diff(phi,theta)),r);

srra := collect(simplify(eval(srr1, r=a)),{cos});
srta := collect(simplify(eval(srt1, r=a)),{cos});

eq1 := coeff(srra, cos(2*theta));
eq2 := coeff(srta, sin(2*theta));
eq3 := 1/2*(T*a^4+2*A*a^2)/a^4;
eq4 := 1/a^2*B;

BB  := solve({eq4=0},{B});
AA  := solve({eq3=0},{A});

sol := solve({eq1=0,eq2=0},{C,D});

phi := subs(BB, phi);
phi := subs(AA, phi);
phi := subs(sol, phi);

srr2 := 1/r*diff(phi,r) + 1/r^2*diff(phi,theta,theta);
stt2 := diff(phi,r,r);
srt2 := -diff((1/r*diff(phi,theta)),r);

srr3 := collect(simplify(srr2),{cos});
stt3 := collect(simplify(stt2),{cos});
srt3 := collect(simplify(srt2),{cos});
```

The stresses at the hole ($r = a$) are

$$\sigma_{rr} = 0$$
$$\sigma_{\theta\theta} = T - 2T\cos(2\theta)$$
$$\sigma_{r\theta} = 0$$

The maximum hoop stress is given at $\theta = 0$ or $\theta = \pi / 2$.

At $\theta = 0$, $\sigma_{\theta\theta} = -T$.

At $\theta = \pi / 2$, $\sigma_{\theta\theta} = 3T$.

The maximum shear stress at $r = a$ is $\tau_{max} = 1.5T$ while that at $r = \infty$ is $0.5T$.

Therefore, the stress concentration factor in tension is $3T / T = 3$, while that in shear is $1.5T / 0.5T = 3$.

Both stress concentration factors are equal.

Let us look at the ratio of the hoop stress at $\theta = \pi / 2$ to the far field hoop stress

$$\sigma_{\theta\theta} = T / 2(1 - \cos 2\theta)$$

The ratio is

$$\text{ratio} = 1 + \frac{3a^4}{2r^4} + \frac{a^2}{2r^2}$$

This ratio is 0.95 when $r \approx 3.5a$, i.e., at a distance of 1.75 diameters from the center.

The given stress function is

$$\varphi = \frac{Tr^2}{4} - \frac{Tr^2\cos(2\theta)}{4} + A\ln(r) + B\theta + C\cos(2\theta) + Dr^{-2}\cos(2\theta)$$

Therefore, the displacement field from the Michell solution is

$$2\mu u_r = \frac{T}{4}[(\kappa-1)r] - \frac{T}{4}[-2r\cos(2\theta)] + A\left[-\frac{1}{r}\right] + C\left[(\kappa+1)r^{-1}\cos(2\theta)\right]$$
$$2\mu u_\theta = -\frac{T}{4}[2r\sin(2\theta)] + C\left[-(\kappa-1)r^{-1}\sin(2\theta)\right] + D\left[2r^{-3}\sin(2\theta)\right]$$

From the stress calculation step, we have

$$A = -\frac{Ta^2}{2} ~;~~ B = 0 ~;~~ C = \frac{Ta^2}{2} ~;~~ D = -\frac{Ta^4}{4}$$

After substituting the constants and collecting terms,

$$2\mu u_r = \frac{Tr\cos(2\theta)}{2}\left[1 + (\kappa+1)\frac{a^2}{r^2} - \frac{a^4}{r^4}\right] + \frac{Tr}{4}\left[(\kappa-1) + 2\frac{a^2}{r^2}\right]$$
$$2\mu u_\theta = -\frac{Tr\sin(2\theta)}{2}\left[1 + (\kappa-1)\frac{a^2}{r^2} + \frac{a^4}{r^4}\right]$$

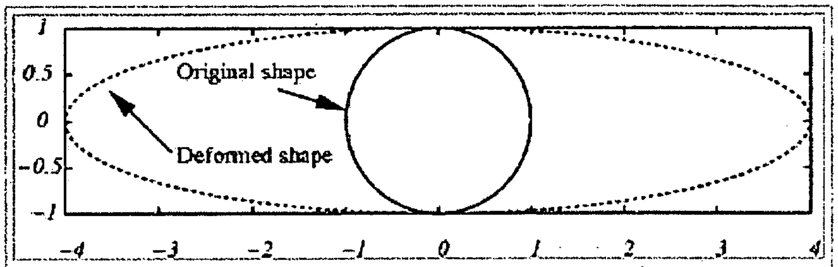
Replacing μ with $E / 2(1 + \nu)$, and κ with $3 - \nu / 1 + \nu$, we get

$$u_r = \frac{Tr\cos(2\theta)}{2E}\left[(1+\nu) + \frac{a^2}{r^2} - (1+\nu)\frac{a^4}{r^4}\right] + \frac{Tr}{2E}\left[(1-\nu) + (1+\nu)\frac{a^2}{r^2}\right]$$
$$u_\theta = -\frac{Tr\sin(2\theta)}{2E}\left[(1+\nu) + 2(1-\nu)\frac{a^2}{r^2} + (1+\nu)\frac{a^4}{r^4}\right]$$

At $r = a$,

$$u_r = \frac{Ta}{E}\left[1 + 2\cos(2\theta)\right]$$
$$u_\theta = -\frac{2Ta}{E}\sin(2\theta)$$

The deformed shape is shown below



Deformation of the hole under tension

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